Injurious Insects of the Year.

A Brief Study in Insect Dissemination.

Advancements Made in Insecticides.

A Visit to the Gypsy Moth Commission.

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Reprinted from the Proceedings of the Ninth Annual Meeting of the Florida State Horticultural Society, 1896.

[From the Florida State Horticultural Society Annual, 1896.]

INJURIOUS INSECTS OF THE YEAR.

Paper prepared and read by Prof. P. H. Rolfs, of the State Experiment Station, Lake City, Columbia county, Chairman of the Standing Committee on Entomology.

[SEE MINUTES PAGES 1 TO 6, ITEM 60.]

Within the last year a great many insects have been sent to the Experiment Station from different counties in the State. While many of the inquiries have merely been to find out the names of these insects and to be sure that they were not destructive species, frequently specimens of destructive species came to the office.

SAN JOSE SCALE (*Aspidiotus perniciosus*).

The most destructive insect that has been found in a new locality is the San Jose scale. Specimens of this were sent from Orlando, Florida, and upon investigation it was found that the local center of the dissemination was located at that city. While the number of trees examined and found to be infested was not very great, enough was found to satisfy me that this insect will be exceedingly severe in that locality. I feel warranted in stating that it will be much more destructive to the pear and peach crop in the Peen-to belt, than it is in the north. Observations indicate that where young peach trees become infested, they will not be able to survive more than two years. While in the northern sections of the State it takes about five years for this insect to destroy a peach orchard. We see, therefore, that it is of the highest importance to see to it that this insect does not get a foot-hold in this particular section of the State.

The work done by the fruit growers of De Funiak and the Experiment Station have proven that this insect can be controlled by the use of resin wash, and at the same time peach growing will not be made a losing business. One point of especial value has been brought out by this work and that is that we must not treat our trees to the stronger resin wash during the winter months, and that we may use this wash in quite a concentrated form during summer.

I have been surprised repeatedly by the greater resisting power that our trees have during summer, than the peach trees have in the North. I think that this can be explained by the fact that our trees produce matured wood by the first of October or even a little earlier, and although they are in full foliage they are in quite dormant condition as far as growth is concerned, and consequently are able to withstand a stronger insecticide than the trees in the far north. However, it does not always follow that old leaves are more resisting to caustic insecticides than new ones, in fact, this has been proven to be quite the contrary in several instances.

About November, 1894, the orchard of A. P. Jones, De Funiak Springs, Fla., containing seven acres was sprayed with resin wash. In the forenoon the normal strength was used, in the afternoon the strength of the insecticide was increased slightly; the results of this increased strength was that nearly all the fruit buds had been de-

stroyed, and rendered the trees fruitless during the summer of '95, but where the normal strength was simply used a considerable fruit had set and matured. The accuracy of this statement can not be doubted as the work was done under the direction of Mr. G. E. Mellish, and the very row to which the work had progressed in the forenoon was indicated by the presence of fruit, while that where the afternoon work was begun, and the increased strength was used was marked by the absence of fruit. From the work that has been done on the San Jose Scale at De Funiak we may condense the following statements, First—the work of spraying with resin wash to control the San Jose scale is profitable in a peach orchard. 2nd.—that the heavier strength of winter wash should not be used during the winter time, but a weaker solution should be used. 3rd.—that the stronger winter wash may be used up to the middle of October. 4th.—that the only difference between the winter resin wash and the summer resin wash, is that the former is more concentrated, consequently, we have no occasion for two formulas. All that is necessary is to indicate the number of gallons to which the compound should be diluted for summer and winter washes.

SUGAR CANE MEALY BUG (*Dactylopius calceolaria.*)

Owners of groves who have had anything to do with the mealy-bug of the orange, know what a severe pest it is to combat. In fact, it seems almost impossible to eradicate it when once established. We have now imported to our State a second species of mealy-bug. It was brought from Jamaica on sugar cane and has become somewhat disseminated. This insect lodges itself between the leaf-sheath and the stem, making it almost impossible to reach it with insecticides. To free seed-cane of this insect, it is necessary to strip the leaves off completely and wash the stalk with some strong insecticide.

This insect will become very severe in the cane fields of the South, unless proper precautions are observed to keep it in bounds. It is already a severe pest in some green houses of the North, consequently, there is danger of infection from this source. Some agriculturist or horticulturist may bring this pest to his premise by simply bringing a few ornaments from an infested green house.

From my own experience with mealy-bugs, I am inclined to believe that it is almost impossible to eradicate the insect when once firmly established, without the total destruction of the plants infested. If any one should unfortunately receive plants or fruit containing mealy-bugs, he will render a service to himself and neighbors to destroy the whole, fruit, insects and wrappings at once.

The mealy-bug that infests our orange trees and also many ornamentals is *Dactylopius citri* (destructor).

SUGAR CANE BORER (*Chilo saccharalis*).

The larvae of this moth have become quite destructive in several cane fields of Florida, and it is one of these insects that the sugar cane grower needs to fear. While there is no danger of it spreading with great rapidity, it is very difficult to combat and keep within bounds. It is the larva of this moth that does the damage to the cane. The eggs are laid upon the body of the stalk of cane and as soon as the larvae hatch, they begin to bore into the body of the sugar cane. The opening in which they enter is so small that it is quite difficult to detect, and it is necessary to strip the leaves off to find the

openings at all. The insects then make a burrow in different directions through the body of the sugar cane, causing great damage in their course. After feeding about thirty days in the body of the sugar cane, the larvae transform into pupae. In this state they come near the surface of the sugar cane stalk so they may emerge as soon as the chrysalis state is over. They remain in the pupa state for about fourteen days, when the insects emerge as full grown moths. The moth is about an inch long, and of a dark gray color. Without any particular markings, it is very hard to detect it on the cane leaves. Very soon after the moth emerges it is ready to lay eggs for another brood of insects. As it requires only about eight or ten days for the eggs to hatch, we have a complete life cycle in less than two months. At the Experiment Station moths emerged from the pupae during February. As these were kept in practically an out door temperature, it was about the same time that it would occur in the field. At this rate we would have nearly or quite four broods during the year in Florida, and very little reflection will indicate to us the great amount of damage that the progeny of a single insect can do in one year.

This insect has long been known to be very destructive to sugar cane in the West Indies and South America, and while it is known to exist in a large portion of the South, it will be disadvantageous to disseminate it throughout Florida. While we are not practically a sugar producing State, a great deal of it is produced for home use and in the local markets a great deal of cane syrup is sold, so it would be a serious disadvantage to have the pest generally disseminated.

The methods of repression are not easily applied; it is almost impossible to destroy the moths or eggs, and to attempt to dislodge them would be to destroy the cane field. About the only practical remedy that can be suggested is to destroy all the refuse cane, including tops and stumps that are left in the field. These should either be burned or buried deeply. Simply plowing them under could not be considered deep enough. The greatest care must be taken in selecting cane for seed, as the burrows which the larva makes are very difficult to detect, and it would not be safe at all to use cane for seed from fields that are known to be infested. Of course insects that are in the cane which is crushed, will be destroyed, consequently, there is no occasion for destroying the leavings from the cane mill. In planting cane I would advise everybody to be exceedingly careful in selecting any seed and to reject all that came directly or indirectly from the West Indies, unless they are absolutely certain that this cane is free from borers.

MEXICO COTTON BOLL WEEVIL (*Anthonomus grandis, Boh*).

In Mexico this insect has been known for years. While it has long been known to entomologists and has done much damage there to cotton plants, it did not occur in this country until 1893. This insect works upon the boll much as the Curculio works upon the peach. The eggs are deposited upon the side of the boll and when they hatch the larvae enter the boll. Every section of the boll that is entered is completely destroyed, even if just one insect is found within. Often several insects are found within a single boll. The origin and distribution of this insect has been worked out by the Division of Entomology, U. S. Department of Agriculture. In 1893 this insect crossed the Rio Grande river at

Brownsville, and from there has been greatly disseminated northward until last year it occurred as far north as San Antonia, Texas.

As early as 1862 cotton culture had to be abandoned in Nonclova, Mexico. It is said that its cultivation was attempted in this district two or three years ago, but the weevil again appeared and destroyed the crop. While this cotton boll weevil may not be of specific interest to the horticulturist, it is still of interest in that it indicates with what rapidity the insect will spread when it is introduced in the country. Under natural conditions this insect would have been longer in going across this watery barrier, but the commercial interchange between these places soon obtained passage for the insect into the United States.

The remedies that have thus far been put into use are about as cumbersome as the remedies used to combat the cotton boll worm.

A BRIEF STUDY IN INSECT DISSEMINATION.

Paper prepared and read by Prof. P H. Rolfs, of the State Experiment Station, Lake City, Columbia county, Chairman of the Standing Committee on Entomology.

SEE MINUTES PAGES 1 TO 6, ITEM 60.]

The most destructive insects to the grove and farm crops of Florida are the scale insects; of these there are about 140 species known to live in the United States. Thirty of these have "been introduced through human agency." The most destructive that fruit growers have to deal with are among the imported species. This is true of other insects as well as the scale insects. The reason for this is quite plain. The number introduced at one time is usually small and located on nursery stock, hence the parasites of these have not found them or if parasitized, the parasites emerging are liable to become bewildered in their new surroundings and lose sight of their host altogether. Without going further into the cause of the absence of parasites, I may state it is as an accepted fact that our most destructive imported pests have comparatively few parasites and that their unusual multiplication is due to their being introduced to disease free and otherwise favorable environment.

I will name a few imported insects that have won more than a local reputation. In New England and Middle States is the imported elm leaf beetle, *Galerucella luteola.* This is spreading with an alarming rapidity and threatens to devastate the famous elms of many a lovely eastern city. The gipsy moth has spread over an area not as large as the smallest county of Florida, and the state of Massachusetts has spent over a half million dollars already to effect its eradication. The legislature is now considering an appropriation of $200,000 to continue the work as it is begun. Our sister state, California has spent over a million dollars in trying to get rid of a single species without avail; I refer to the fluted scale, *Icerya purchasi.* Her nurseries have disseminated the San Jose scale to all fruit growing sections causing heavy losses to many states

and minor losses to Georgia and Florida. The West Indies have contributed one scale insect, *Diaspis amygdali* (*lanatus*), at least to the fauna of Florida. This insect is as hard to eradicate as the San Jose scale, but fortunately it has not been disseminated very extensively. Recently I have received specimens of *Dactylopius calceloria*, mealy bug of sugar cane, destructive in Jamaica and at the same time some specimens of sugar cane borer, *Chilo saccharalis*. This insect is from the West Indies. Already have we reports that cane fields have been rendered entirely worthless by the action of the last named.

To recapitulate,—Europe has contributed four very destructive pests to our fauna; Australia one; South America one and West Indies three.

None of our industries are so exceedingly remunerative that we can afford to invite wholesale loss with the idea of cutting down production and thereby limiting the supply. It is not necessary for a pest to eat up a whole crop in order that we may destroy an industry. The margin of profit is usually very narrow and the shrinkage of ten per cent often turns the balance from profit to loss.

You ask me if there are any destructive insects in the countries outside of the United States that have not been imported? I will say that there are 130 species of scale insects in Central and South America and the West Indies that have never been found in the United States. *Aspidiotus articulatus* and *Aspidiotus scutiformis* are both destructive to the citrus plants, the former in the West Indies, and the latter in Mexico.

Many of these insects simply await the introduction to this country to become serious pests. We can not rely upon climate as a boundary to their progress. For example; the mealy bug of the West Indies is already firmly established in Florida and infests many green houses of the North. *Diaspis amygdali* (*lanatus*) a West Indian species is widely disseminated in Florida and infests peach trees as far north as Washington, D. C. The cotton boll weevil of Mexico is making an alarming march northward into middle Texas. We can not tell therefore, whether a particular species will be limited to a particular climatic zone, until it has been tested and then it will be too late to check its ravages.

ADVANCEMENTS MADE IN INSECTICIDES.

Paper prepared and read by Prof. P. H Rolfs, of Lake City, Columbia county, Chairman of the Standing Committee on Entomology.

[SEE MINUTES PAGES 1 TO 6, ITEM 60.]

The decided success obtained from combatting the Colorado beetle with arsenic gave a heavy impetus to the methods of combatting destructive insects. A great many different substances have been tried with varying success. Many of these materials are of no value whatever, from an economic standpoint. The idea of using a liquid solution for combatting these enemies of farm crops is very firmly grounded in the mind of the Agriculturist. By far the greater number of experiments are made in this particular line, consequently, we find the greatest amount of advancement along this line of study.

Among the late improvements for combatting leaf eating insects is the change in the form of arsenic used. This has been brought out prominently by Prof. Fernald, Entomologist of the Massachusetts Experiment Station. It was found that by using arsenate of lead, instead of using Paris green or London purple, that a greater amount of poison could be used without proving caustic to the trees. That is, the arsenate of lead would prove less caustic to the foliage of plants than the other forms of arsenic. Prof. Fernald described the process of making the arsenate of lead in the following way, "place eleven ounces of acetate of lead, and four ounces of arsenate of soda in a hogshead containing 150 gallons of water. This substance will dissolve quickly and form an arsenate of lead in the form of a white powder which remains in suspension," or we may use twenty-seven per cent of arsenate of soda and seventy-three per cent of acetate of lead by weight. Dissolve these saparately and they may then be mixed and the arsenate of lead will be precipitated. The strength of this mixture may be increased so as to use 22 ounces of arsenate of lead and four ounces of acetate of soda to 150 gallons of water. Care should be taken to use a sufficient amount of acetate of lead to use up all the arsenate of soda as the arsenate of soda is caustic. This substance will prove quite valuable to vegetable growers of Florida. It has the advantage of being nearly colorless, consequently, not specking the fruit or vegetables. Frequent analyses indicate that the danger of poisoning from arsenate by eating fruit that has been sprayed with them, is very little indeed. Of course this insecticide will not prove valuable against the various scale insects and all such pests that feed below the epidermis.

ADVANCEMENT IN MACHINES.

Comparatively speaking Florida has no doubt, more spraying machinery in the field than any other state. Many of our orange growers do not hesitate in saying

that a spraying machine is as necessary as a fertilizer, and many vegetable growers are equally or even more emphatic in their assertions, but even with the long list of spraying machines that we have, New York is ahead of us in the elaboration of machinery for this work. Almost without exception, all machines in Florida are run by hand. In New York city where the imported elm leaf beetle is very destructive to shade trees, much more powerful machinery has to be used. Consequently, powerful machinery has been prepared and run by steam power. In other places there are machines that are run by steam power. At West Point on the grounds belonging to the Military Academy, a fire engine has been transformed into a spraying machine This machine also is run by steam power. In the case of New York city the liquid has to be thrown to a height that can scarcely be attained by hand power.

A VISIT TO THE GYPSY MOTH COMMISSION.

Paper prepared and read by Prof. P. H Rolfs, of the State Experiment Station, Lake City, Columbia county, Chairman of the Standing Committee on Entomology.

[SEE MINUTES PAGES 1 TO 6, ITEM 60]

Members of the Horticultural Society are doubtless acquainted with the fact that more than fifteen years ago this Gypsy Moth was imported from France to Massachusetts, and escaped from confinement. Very little attention was paid to the insect for a number of years because its ravages were confined to so small an area, but finally the insects became disseminated from one estate to another until finally a whole township and then a county was over run with them, while in its home, France, the insect attracted but little attention and is not considered bad; it has become so serious a pest in Massachusetts that it not only threatens the destruction of forests but also cultivated crops. Some of the district throughout which this insect has been distributed is forest land and only held in reserve. Consequently it is not sufficient to eradicate it from the cultivated fields. The district over which this insect is disseminated is fifty miles long and a few miles wide.

Probably the most seriously infested place is near Malden, at which place this Moth Commission has its headquarters. Upon visiting this place I met Mr. Forbush and his assistants, who gave me all the information I desired, and also made me acquainted with the different methods used in combatting this insect.

EQUIPMENT.

A great many different methods for combatting this insect have been tried; the first that came to mind was spraying. However, to treat so large an area completely and to consider the great number of hiding places that this insect has, it became apparent that this could not be used as a means of eradicating the pest. However, where the insect was abundant enough to threaten the death of trees and shrubs, this had to be resorted to for temporary relief. Two forms of insecticides were used: those that kill by contact and those that kill by poisoning. Of these the latter was found

to be the most important, and by later investigation it was discovered that arsenate of lead gave better results than any other forms of arsenic. Many of the trees were exceedingly valuable and at the same time very large, so it was necessary to use a very strong spraying machine and a large force of men to work it. The force used was man power. I saw no machine that was run by steam power in this place. In cases where the trees were exceedingly valuable and severely infected they proceeded in somewhat the following manner;—The trees were thoroughly sprayed to begin with to kill as many of the larvae as possible, and after that men provided with telegraph climbers worked their way all over the large limbs of the tree, scrubbing them down thoroughly with the wash, to kill off all the insects and nests of eggs that were found. At the same time all the limbs in the trees that could possibly be spared were removed and burned. After a time it was discovered that in removing the egg masses a portion of the eggs would fall to the ground to hatch, and the insects would crawl up the trees to continue their devastation. Consequently a second insecticide was used. This is an exceedingly caustic preparation and when applied to the egg mass it kills quickly, and the eggs are allowed to remain where the female deposited them.

As soon as the larvae have become full grown they descend the tree, either to the ground or to some hiding place on the tree, as cracks and hollow places, and there pupate. These larvae often congregate to the number of several hundreds in the crotches of the tree. After emerging from the chrysalis state the females ascend the trees to deposit their eggs. The destruction of the larvae can not be complete, so it is always necessary to go over the ground after the larvae have pupated to destroy the pupae. As has been mentioned before these occur among rubbish, under boards, in tin cans or anything that will afford a dark hiding place. Old stone fences, which are very common in this district, are favorite hiding places. To combat this insect in this stage a kerosene machine was made; the essential parts of which are a large tank to hold five or ten gallons of kerosene and hoses leading from this to supply nozzles with kerosene. The nozzles are simply long iron pipes with asbestos wrapped about the distal end. Kerosene is discharged on the asbestos and ignited. With these large torches much effective work can be done, but it is impossible to kill all of them where they have crawled into a wide stone fence. The only remedy in such a case is to tear the fence actually down. At the proper time of the year the forest area is burned over, and in this way many insects are destroyed.

EMPLOYEES.

Professor Fernald, Entomologist of the Massachusetts Experiment Station, is at the head of the Commission. Besides him they have employed five or six assistant entomologists, and Mr. Forbush is Director of the Field Work. The work of the entomologist consists mainly of working over material and preparing information. Very close scientific study is being made of the methods of dissemination and general life history of the insect. While at first sight this seems to be rather superfluous in view of the fact that the life history of this moth is pretty thoroughly known to entomologists, but these men are by all odds the most important agents in directing the work properly. For example, it has long been known that these insects would spring

up spontaneously. This was thought to be so as no material was being carried from one district to another, and all people in the infected district were very careful not to aid in the dissemination of the pest. Later it was discovered that the eggs of this insect were eaten by various species of birds but were not digested.

SCOUTS.

Besides the entomologists there are men employed who are known as scouts. These are such men as are entirely familiar with the ordinary work of the farm, and who have had a fairly good education and are quick observers, but who have not had the advantages of a college training. As soon as these men are trained to know the insect, eggs, larva and pupa, they make excellent field hands to use in making observations on this pest. These men are employed to traverse the district in the same way as field geologists, except that they cover the field much more thoroughly. These scouts bring in all the insects captured, and mark the spot where the insect was taken. A special code is used for marking these places so the people connected with this work are able to tell just what stage the insect was taken, and from what place and at what time. A record of this is also made in the field book. The report is then filed in the office; so that every place where the insect has been found can be again found and worked over when it is desirable. The report of every scout is so perfect that the exact location, whether it was two years before or later, can be found by the employees of the Commission without unnecessary delay.

LABORERS.

The laborers are men who are hired to perform such work as requires no especial fitness, such as pumping the spraying machine, tearing down fences, etc.

RESULTS OF THE WORK.

The money at the command of the Gypsy Moth Commission was not sufficient to warrant an attempt at the destruction of the insect as a whole, consequently it was necessary to attack it in certain localities, and if possible to get it surrounded so as to keep it from spreading. This seems to have been effective, as no new outbreak has been reported for some time. In some places where the insect was formerly severe no insects were found last year, so while the work is not as yet complete, there is no doubt as to the ultimate end if the state will simply persevere in pushing the work forward. It seems like a gigantic undertaking to search over so large an area and try and find all the insects and eggs by simply looking for them. However, that is about what it has resolved itself into. Now this work may seem like a very clumsy undertaking, yet in all the important centers and important shade trees the insect has nearly or quite been destroyed, and these have put out new growth and are better shade trees than the year before. Cultivated crops are no longer threatened.

RESULTS IF THE WORK HAD NOT BEEN DONE.

Just what the results would have been had no work been done can be easily foretold. The repeated attempts by private parties to subdue the pest in their own fields proved entirely unsatisfactory, inasmuch as their premises would soon be stocked from their neighbors' fields. The effects upon the forests were also becoming painfully apparent; the trees defoliated in spring and early summer sent out new growth in early fall that was killed by early frosts. It was simply a matter of time until all the hills should become barren. While the parks and lawns could easily be taken care of by their owners, this forest land that scarcely pays taxes would have been devas-

tated, and the bleak winter winds would have supplied the people of the districts with veritable north-west blizzards. In sparsely settled districts like ours people have very little notion of the value of a forest to the country, and we Americans as a whole are absent minded in regard to forest destruction and its influence on climate. We can scarcely understand the high estimation in which shade trees in New England are held. I remember seeing one large elm that was by no means a fine specimen of a tree, inasmuch as the branches were low and each one seemed to have a head of its own, scarcely the shape of a tree, and anything but desirable. Under it stood a very fine house, vauled at from five to seven thousand dollars. The owner of the house had given directions to the chief of the fire department that in case of fire the tree was to be protected at all hazards, and the house saved if possible. If it was a question as to which could be saved the house was not to be taken into consideration. Now this was not mere idle talk on the part of the owner of the property. These orders would be carried out in case of fire. In other words, we may say that this tree was valued at five thousand dollars, and no doubt but that the removal of this tree would depreciate the selling price of that property several thousand dollars.